
Modeling heart disease in a dish: From somatic cells to disease-relevant cardiomyocytes.

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Public Summary:

A scientific milestone that has tremendously impacted the cardiac research field has been the discovery and establishment of human-induced pluripotent stem cells (hiPSC). Key to this discovery has been uncovering a viable path in generating human patient and disease-specific cardiac cells to dynamically model and study human cardiac diseases in a tissue culture dish. Recent studies have demonstrated that hiPSC-derived cardiomyocytes can be used to model and recapitulate various known disease features in hearts of patient donors harboring genetic-based cardiac diseases. Experimental drugs have also been tested in this setting and shown to alleviate disease phenotypes in hiPSC-derived cardiomyocytes, further paving the way for therapeutic interventions for cardiac disease. Here, we review state-of-the-art methods to generate high-quality hiPSC and differentiate them towards cardiomyocytes as well as the full range of genetic-based cardiac diseases, which have been modeled using hiPSC. We also provide future perspectives on exploiting the potential of hiPSC to compliment existing studies and gain new insights into the mechanisms underlying cardiac disease.

Scientific Abstract:

A scientific milestone that has tremendously impacted the cardiac research field has been the discovery and establishment of human-induced pluripotent stem cells (hiPSC). Key to this discovery has been uncovering a viable path in generating human patient and disease-specific cardiac cells to dynamically model and study human cardiac diseases in an in vitro setting. Recent studies have demonstrated that hiPSC-derived cardiomyocytes can be used to model and recapitulate various known disease features in hearts of patient donors harboring genetic-based cardiac diseases. Experimental drugs have also been tested in this setting and shown to alleviate disease phenotypes in hiPSC-derived cardiomyocytes, further paving the way for therapeutic interventions for cardiac disease. Here, we review state-of-the-art methods to generate high-quality hiPSC and differentiate them towards cardiomyocytes as well as the full range of genetic-based cardiac diseases, which have been modeled using hiPSC. We also provide future perspectives on exploiting the potential of hiPSC to compliment existing studies and gain new insights into the mechanisms underlying cardiac disease.

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